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In 1905 the bushes and trees were close to the ice and there was no bare zone, or at most a very narrow one, visible between the ice and the forest. In 1909 the front of the ice seemed to be a little in advance of its position of four years before. At the later date near the front of the glacier on the south side was a brown zone estimated to be 200 feet in width. This brown zone appeared to have been caused by dead vegetation rather than by bare rock, and at the edge of the ice there were a few small trees. Close to the glacier there was a sparse forest which contained trees estimated to be ten inches in diameter. Hence the ice was probably as far forward in 1909 as it has been during the last hundred years or more.

Two glaciers join about two miles back from the front to form the main body of the Meares Glacier, and a small medial moraine extends seaward from the point of junction. The ice stream from the north is the larger of the two small streams, and it probably comes from a snow-field which discharges northward also into the Yale Glacier of Port Wells. The front of the Meares glacier is a clear white wall of ice with delicate blue shadows, and although it is not as large as several other glaciers of Prince William Sound, it is, nevertheless, one of the most beautiful.

LOCATION OF THE TOWNS AND CITIES OF CENTRAL NEW YORK

BY

RALPH S. TARR

LARGER GEOGRAPHIC FEATURES. The largest geographic province in the State of New York is a hilly plateau (Fig. 1), the northern portion of the Appalachian plateau which skirts the western base of the Appalachian mountains. This plateau extends northeastward to the Hudson River, where it is known as the Catskill mountains; thence it stretches westward to the western boundary of the State and southward into Pennsylvania. To the north of the plateau, in eastern New York, rise the Adirondack mountains, with the valley of the Mohawk River forming a broad depression between the Adirondacks on the north and the plateau on the south. In central and western New York the plateau is terminated on the north by a more or less perfectly developed escarpment, beyond which, to the north, lies a plain of very level character which extends to the shores

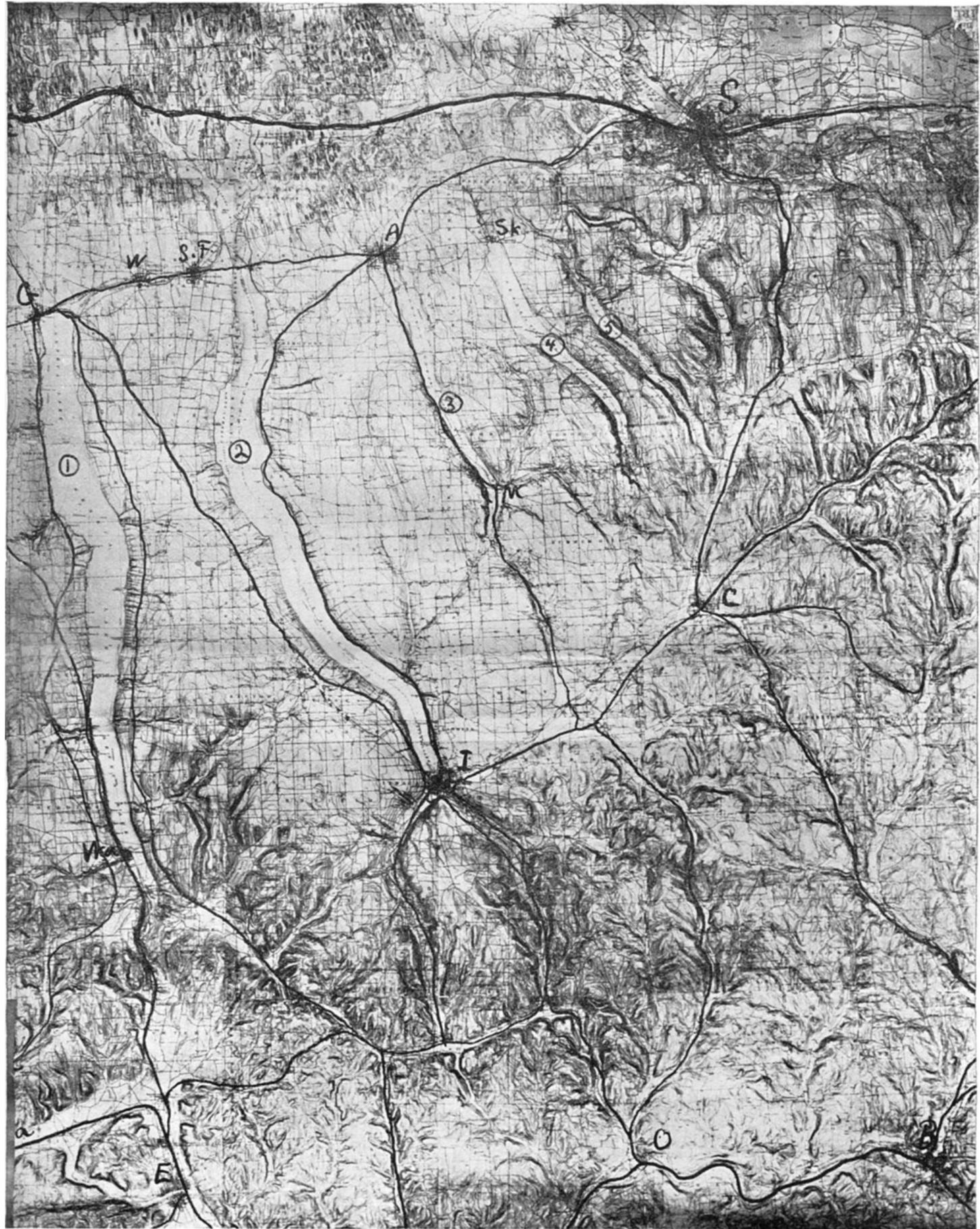


FIG. 1—Photograph of a part of the U. S. Geological Survey topographic map, showing the Finger Lake region of Central New York. The railway lines drawn in ink: a b, southern highway; c d, northern highway; B., Binghamton; O., Owego; E., Elmira; Wa., Watkins; I., Ithaca; C., Cortland; M., Moravia; G., Geneva; W., Waterloo; S. F., Seneca Falls; A., Auburn; Sk., Skeneateles; S., Syracuse; 1, Geneva Lake; 2, Cayuga Lake; 3, Owasco Lake; 4, Skeneateles Lake; 5, Otisco Lake.

of Lake Ontario. Further west is a still narrower plain between the escarpment and Lake Erie.

THE HIGHWAYS. These geographic features, and others, have had an important influence on the growth and development of the State as a whole. The fact that the Hudson valley, submerged to admit the sea, crosses the northern extension of the Appalachian mountains, has opened a highway toward the interior, which is continued westward by the Mohawk valley until the rugged plateau is crossed and the level lake plains reached. From the Canadian line to the southern tip of the Appalachians, in Alabama, there is no similar highway across the mountain and plateau barrier which lies between the seacoast and the fertile plains of the Mississippi valley.

It is well known how very important this highway toward the interior has become, first by the building of the Erie Canal, then by the construction of trunk railways. This has come to be one of the great routes of commerce in the world; and it has not merely led to the growth of the metropolis of New York on one end and Buffalo on the other, but has affected the whole State and has exercised a profound influence on the development of the country to the west. This highway will not, however, have attained its full degree of usefulness until it is possible for boats starting from Duluth and Chicago to freely pass over it and out to sea. Perhaps it will be not until the wisely planned works of the Canadians have begun to produce their inevitable economic effects on our own country that people in general will awaken to the truth of this statement; but I have faith that ultimately there will be full recognition of the fact that there is here a geographic invitation to reap great profit at relatively small expense. The invitation was early seen and accepted, in a way suitable to the times; but there has been no Governor Clinton of late.

Besides the dominant Hudson-Mohawk-Great Lakes Highway (Fig. 1, c d), there is a highway of secondary importance along the Susquehanna valley in southern New York (Fig. 1, a b). The Susquehanna is one of the few Appalachian rivers that heads in the Appalachian plateau and then flows across the entire mountain area to the Atlantic. It heads far back in the plateau, but not far enough to offer a complete passage, and in this respect is inferior in value to the Mohawk. Moreover, it empties into the sea many miles to the south of New York, and for that reason, also, it offers a much less inviting route for products from central New York than the shorter route via the Mohawk. As a route for products from the interior plains to the ports of Philadelphia or Baltimore the Susque-

hanna is distinctly inferior to other routes across the mountains further south.

For these reasons the Susquehanna route has never attained high importance; but parts of the valley across the mountains and plateau have been utilized by railways which have chosen a route across country, from New York to Buffalo, in competition with the Hudson-Mohawk route. Thus the Erie, Lehigh Valley and Lackawanna railways, crossing the mountains by winding courses with heavy grades, descend into the Susquehanna valley and then follow it for a portion of its course in their way across the plateau, each route diverging from the Susquehanna into some cross route leading toward the lake plains. Thus in New York the Susquehanna valley is a highway of some importance, but in no respect equal to the Mohawk-Hudson highway.

INHERENT RESOURCES. The three larger geographic provinces within the State whose influence affects the growth and development of the region under consideration,—the Adirondacks, the plateaus, and the lake plains—vary greatly in the amount and kind of contribution toward the growth of industrial centers. In each of the provinces there is water power of greater or less value; in each there is some mineral wealth; in each there is agriculture; and in each there is lumber; but in each the relative value of these resources varies greatly. There is most water power in the Adirondacks where it is least needed and least used; there is least in the plains where it would be most useful. There is much lumber in the Adirondacks and also a great quantity in the hilly plateau, but little on the plains. The mineral wealth includes building stones, clay, cement materials, salt and iron, besides mineral products of lesser value. The first three are widely distributed; the salt is confined to the central part, in the plateau and on its northern edge; and the greatest amount of iron comes from the Adirondacks.

The Adirondack province is the region of greatest economic poverty, for much of it is a forest-covered wilderness, the home of the lumberman, and in summer of the sportsman and the summer visitor. There is little agriculture, for most of the surface is too rugged and the soil too thin. The lake plains, with a level surface, a deep, fertile soil, and a genial climate modified by the presence of the large bodies of lake water, form an agricultural belt of great productiveness and the seat of a prosperous farming community. In the plateau country, too, there is much agriculture, but it varies greatly in kind and value from place to place. Toward the north, where the plateau surface is lower and more level, there is extensive

and profitable farming; and the larger valleys are the seats of prosperous farms. But in the upland, as a general proposition, farming is far less successful. Although there are many small areas of fertility, and individual farms quite equal in value to some of those in the valleys, in the main, the plateau region is not adapted to the highest grade of agriculture. There are extensive areas too steep for crops and others with a soil too thin for successful cultivation. Much of the area is in forest, and still more in pasture; dairying and sheep raising are prominent industries; markets are often remote and difficult to reach over bad roads and steep grades; and for several decades farming in the plateau region has been on the decline and the rural population has been decreasing.

CONTRIBUTING RESOURCES. Fortunately, this region does not have to depend upon its own inherent resources, for, being on or closely in touch with the great highways mentioned above, it easily receives resources which other sections are able to contribute out of their abundance. Of these resources none are more important than the coal from Pennsylvania. The Lackawanna and Lehigh Valley railroads cross the anthracite fields on their way between New York and Buffalo; and other roads tap the bituminous coal fields further west. In seeking an outlet for this coal, railroads reach out to the Erie Canal route and to the Great Lakes as well as to the seacoast, and those railroads wind their way across the plateau of central New York. Much of the industrial development of the valley towns of the plateau region, as well as of those along the Erie Canal, depends upon the coal thus brought to them; and the towns on the way are further influenced by the transportation facilities that the coal-carrying roads furnish. It is safe to say that there would be not only fewer but far less important railroads through the sparsely settled plateau region of central New York if the coal carrying trade had not encouraged their construction.

The dispersion of products, upon which successful manufacturing depends, is thus well provided for in the greater part of the plateau region (Fig. 1). From its own resources the plateau country could hardly have invited such extensive railway construction; but being crossed by two important highways from seacoast to interior, and having extensive coal fields on the southern side seeking outlet to the northern highway, the more important valleys are threaded by lines of railway. Since these cross lines connect on the northern end with the Great Lakes and the Mohawk-Hudson highway, they make the regions that these routes connect indirectly tributary to the needs of the valley towns of the central New York plateau.

CROSS ROUTES. Thus, in addition to the two great highways there are numerous cross routes, or byways (Fig. 1). Like the highways, these are dependent upon physiographic conditions. In a word, they are stream-made valleys cut in the plateau and modified, in one way or another, by glacial action. Along these valleys roads and railroads have been built. To understand the nature of these cross routes calls for a brief description of the plateau region.

It is a broad area of nearly horizontal strata, with the upland rising from 1,500 to 2,000 feet above sea level. Long-continued denudation has greatly dissected the plateau, giving rise to a mature topography, with broad, deep valleys and undulating hill tops rising to a fairly uniform level. Looking across country from the crest of one of the upland hill tops, the appearance is that of a plain; but from the valleys one sees steep slopes and a hilly country; and a journey across country confirms the latter impression, for one must go up and down hill and across a succession of broad, deep valleys in any such journey (Fig. 1).

While the plateau region is a stream-dissected country in the main, it has received profound and important modification as a result of glacial action. Glacial erosion has broadened and deepened many of the valleys, especially those extending north and south in the direction of ice flow, like those occupied by the Finger Lakes. Such erosion has lowered the bottoms of some of the valleys even below sea level, and in the basins thus produced, and in part behind dams of glacial drift, long finger-like lakes have been formed.

Glacial erosion has worked laterally, as well as vertically, steepening the valley slopes here and there, often making them so precipitous that the forest alone grows upon them. The steepened slopes of the larger valleys, such as Cayuga and Seneca (Figs. 4 and 7), terminate on the upper side at a fairly uniform level at which the tributary streams enter, hanging high above the valley bottom. These *hanging valleys* have moderate grade above this level, but their water is precipitated down the steepened slope of the main valley in a series of cascades, in picturesque gorges, furnishing water power at a number of places.

Ice erosion has introduced modifications in the topography in still a third, and even more important way. As the ice swept across the divides of the preglacial streams, perched high up in the plateau, it scoured them down, thus greatly decreasing the grades from one valley to the other. In many cases the divides between streams flowing north and south were worn entirely away and the two opposing valleys united into a single *through valley* (Figs. 1, 2, 3, and 4),

graded up more or less by glacial deposit. After the glacier disappeared many streams in valleys that in preglacial time sloped northward and shed their waters into the St. Lawrence system, were now so united with south sloping valleys that the waters flowed into the Susquehanna system. In this way the headwaters of the Susquehanna have received notable accessions robbed from the St. Lawrence drainage area. The through valleys have also been straightened and widened by lateral ice erosion, cutting off the overlapping spurs.

The newly established grades of the through valleys, made by glacial erosion and deposit, have opened up many gaps across the plateau, and these the railroads follow. Had it not been for this modification of the topography by ice action we may be sure that railroad building in the plateau region would have been far more difficult than now, and many of the present railways would have been quite impossible because of the heavy grades up to divides and the need of tunnels on the way. Under present conditions the passage of the plateau is easy, especially along the through valleys at the southern ends of the valleys of the Finger Lakes.

These through valleys form the leading cross routes, or byways, between the Susquehanna and Mohawk-Great Lakes highways (Figs. 1-4). They are rendered still more important by the deep, long, narrow lakes which occupy a part of their course and are useful for navigation. The two largest of these lakes, Cayuga and Seneca, are united by canal with the Erie Canal; but at present the traffic by rail from north to south across the plateau province is of much more importance than that by water.

There are no cross routes in the plateau province in an east and west direction, because the glacier eroded only the divides between north and south flowing streams. To go by rail from Ithaca to Watkins, for example, a distance of about 20 miles in an east-west direction, one must go south, then west, then north, travelling around three sides of a quadrangle (Fig. 1). Similar roundabout journeys are necessary between most points lying on an east-west line; but railway travel north and south is much more simple and direct.

CITIES ON THE NORTHERN HIGHWAY. Along the Hudson-Mohawk-Great Lakes Highway, from New York City to Buffalo, there is a succession of villages, towns and cities closely spaced along the entire route. The importance of this transportation route is indicated most clearly by the size and growth of the two cities at its end—Buffalo, where it touches the Great Lakes, and New York City, where it touches the sea. Naturally, these are the two largest cities of the State, because of their location at the two ends

of the leading highway. Naturally, also, the cities next in size in the State are at favorable points on this same great highway.

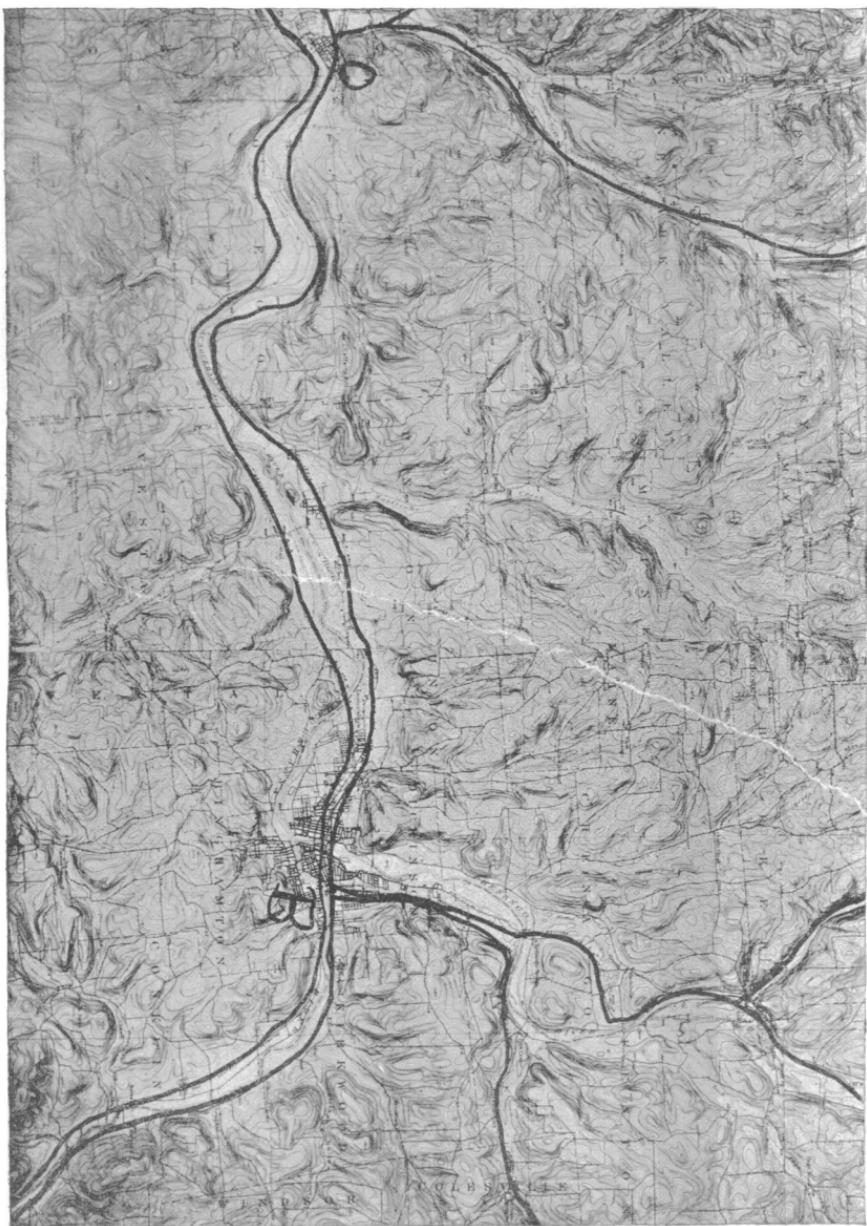
Next in size to Buffalo is Rochester on the Erie Canal and New York Central Railway at a point where the highway is crossed by the Genesee River, which here tumbles in great falls, furnishing water power of great value. The city lies in the midst of a fertile agricultural region; it is near enough to Lake Ontario to benefit from the shipping on that large water body through its port Charlotte; and it is at the point of junction of routes from the broad and fertile upper Genesee valley with the east-west highway.

Ranking next to Rochester is Syracuse, less favorably situated and to-day profiting little from the cause which led to its foundation and early growth. Salt making is practically an industry of the past in Syracuse, though salt waters which are led from the plateau region to the south to the suburb Solway sustain a thriving industry there. Toward Syracuse from the south lead three through valleys which, uniting north of Cortland, are continued southward by a continuous through valley to Binghamton (Fig. 1). This is one of the most important north-south cross routes in central New York and it extends northward to the lake port of Oswego. The fact that Syracuse is situated at the point where this cross route intersects the great east-west highway is one of the factors in the growth of the city. The cross route unites Syracuse with the anthracite fields, as the east-west highway connects it with the sea and the Great Lakes.

Next in size among the cities of New York are Albany and Troy, both practically at the point where the Mohawk from the west unites with the Hudson from the north; and after these cities come Utica and Yonkers, the former at the head of the Mohawk, the latter just above New York City. All four of these cities lie outside the area with which this paper is immediately concerned. Many smaller cities, towns and villages lie along the highway between New York and Buffalo, all dependent upon the facilities of transportation which the highway offers, and most of them further influenced by the convergence of cross routes toward their site, or by some other favorable geographic condition.

CITIES ON THE SOUTHERN HIGHWAY. Among the cities of New York the ones next in size to those mentioned are located on the Susquehanna-Chemung highway. These are Binghamton and Elmira (Figs. 1 and 2), to which also should be added Sayre in Pennsylvania, just across the southern boundary line of New York. Waverly in New York is practically one of the outskirts of Sayre.

FIG. 2.—Photograph of a part of the U. S. Geological Survey topographic map, showing the location of Binghamton (B) and Owego (O) on the southern highway.



Each of these cities depends for its growth upon the convergence of cross routes upon the southern highway. Binghamton (Fig. 2), on the Susquehanna, is at the point where the Chenango River enters, and it is along this valley that the cross route to Syracuse runs, as well as one northeastward to Utica, and still a third, diverging from the second and rejoining the Susquehanna higher up, leading toward Albany.

Sayre lies where the Susquehanna turns southward, at the junction of the Chemung, and at the point where a through valley enters, which, branching at Van Etten, opens routes to both the Seneca and Cayuga valleys. The Lehigh Valley Railroad, coming up the Susquehanna, enters this through valley and, by easy grade, continues along the Seneca valley on its way across the plateau toward Buffalo; and a branch line diverging from it at Van Etten follows the Cayuga valley, reuniting with the main line at the lower end of Seneca lake.

The Lackawanna and Erie railways, coming down the Susquehanna from above Binghamton, enter the Chemung valley at Sayre and pass up it through Elmira (Fig. 1). Another through valley, leading southward from the Seneca valley toward Elmira, is followed by two lines of railway; another railway enters Elmira from the south, and a third, by a difficult route, over a part of the plateau, from the northeast.

The influence of the convergence of highways on the growth of centers of population in this hilly country is further illustrated by several smaller places in the Susquehanna valley, which is deeply sunk in the plateau. For example, Union lies at the mouth of Nanticoke Creek; Owego at the mouth of Owego Creek; and an examination of the U. S. Geological Survey topographic map will show still other instances.

In such a hilly country it follows, of necessity, that the chief travel and transportation must be along the valleys, and, consequently, that the points of their convergence will become centers of industry and population roughly proportionate in importance to the volume of trade carried along the routes. These points of convergence become junctions and places of transfer; and they become handlers, manufacturers and distributors of the products contributed by the converging highways. That the towns and cities at these points are no larger is due primarily to the fact that they lie in a region of limited resources, having little material to contribute for manufacture and distribution, and in a region of sparse population demanding little from abroad or from local manufactories.

That the larger centers of population along the southern highway are smaller than those along the northern highway is due partly to the fact that the surrounding country is less prosperous and productive, partly to the fact that the highway is secondary in importance as a through route, and partly to the fact that this route cannot contribute the same variety of resources from outside, at the same expense, as can be done along the northern highway. That the cities have attained even their present size is in no small degree due to the fact that they lie near to the coal fields and are reached by leading coal carrying roads.

THE CROSS ROUTE CITIES. It would be tedious to consider these routes one after the other. All the cities and most of the towns and larger villages between the northern and southern highways lie along the cross routes, and the causes for their location fall into a few categories which can easily be stated in a consideration of the two types of cross routes:—(1) the continuous through valley; (2) the through valley with a lake at one end.

Of the former the cross route from Binghamton to Syracuse may be considered as typical (Fig. 1). For the greater part of its length this route lies in a narrow valley deeply set in the plateau and bordered by steeply rising sides. The narrow floodplain is closely farmed, where not too wet; and where not too steep the valley slopes are also cultivated, though less successfully. Farms occupy the upland on either side, but the population is sparse and decreasing. A railway line joining the southern and northern highways follows this cross route.

Here and there side valleys enter, and along most of them roads descend from the upland. Groups of houses and small villages are commonly found in the main valley at such points; or, if the entering valley is large, opening up a larger area of tributary country, there may be a good-sized village. Here and there a creamery, or a grist mill may be seen manufacturing local products, and in some cases making use of water power of a stream descending swiftly from the upland, or of some low fall in the main stream itself. Occasionally there is a small manufacturing plant which depends upon the outside for both its fuel and its raw material.

At only one point in all the distance between Binghamton and Syracuse is there any notable concentration of population. This is at Cortland, which is located in the most favorable situation along the entire route (Fig. 3). In the first place, it lies about midway between Binghamton and Syracuse and is thus able to serve a large area of surrounding country that is beyond the easy reach of these

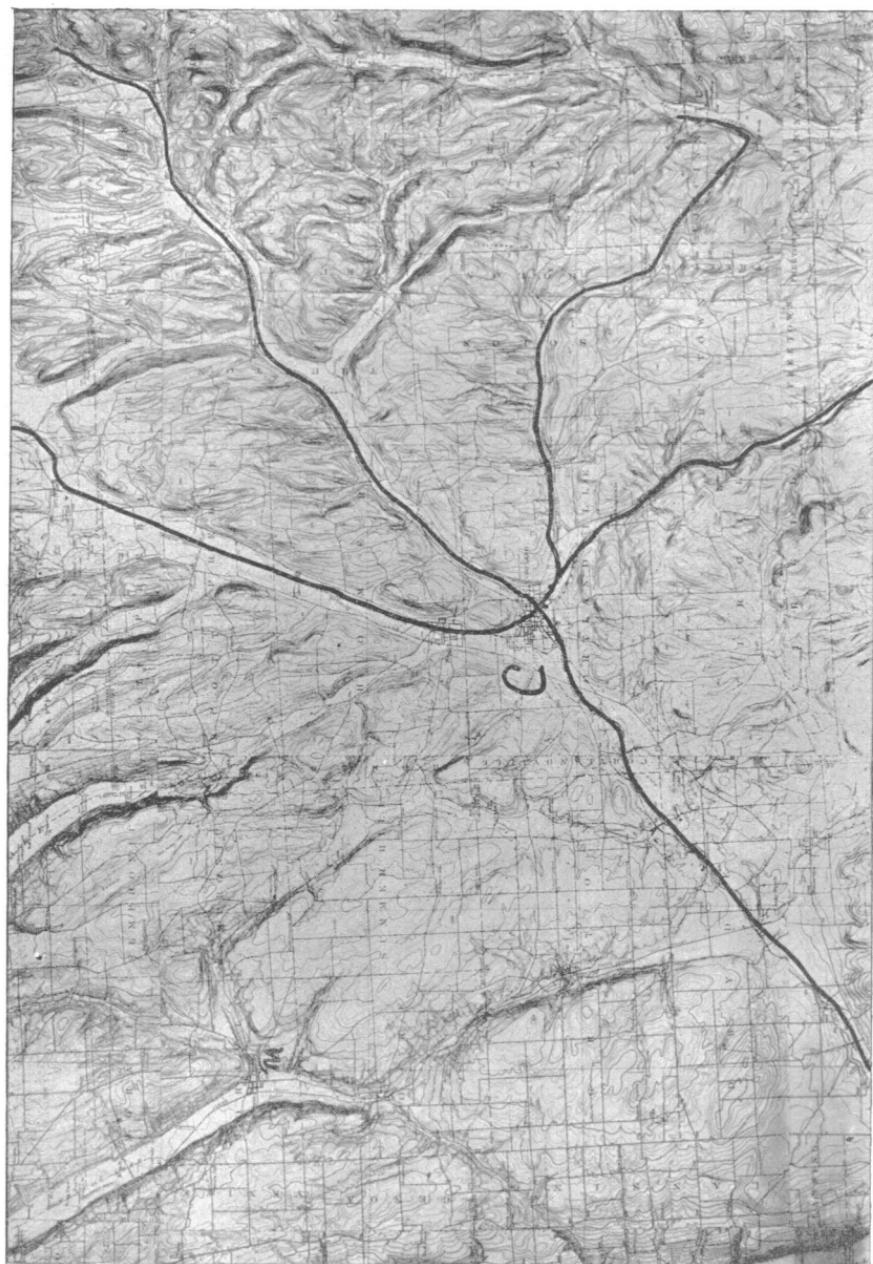


FIG. 3—Photograph of a part of the U. S. Geological Survey topographic map showing location of Cortland (C) and the railways (heavy black lines) converging on that center. M. Moravia.

two cities. But far more important than this is the fact that it is situated at the most extensive convergence of highways in the central part of the plateau region. Six valleys radiate from this center, and along five of them railways run. In consequence of its favorable situation, Cortland has grown rapidly and has become one of the leading manufacturing centers in the plateau region.

The Seneca and Cayuga cross routes may be taken as typical examples of the second class of cross routes (Figs. 1, 4, and 7). Toward each of the lakes through valleys converge from the south, connecting them with the Susquehanna highway, while the lakes themselves extend almost up to the northern highway. Two such through valleys converge toward each of the lakes, one from Owego and one from Sayre toward the Cayuga valley, and one from Sayre and one from Elmira toward the Seneca valley. Along these through valleys south of the lakes the conditions are quite like those in the cross route already described; but in the part of the route occupied by the lakes the conditions are quite different.

LAKE HEAD TOWNS. There is a town at the head of each of the lakes: Ithaca at the head of Cayuga Lake and Watkins at the head of Seneca Lake (Figs. 1 and 4). Each of these owes its location to the shipping facilities on the lake, each of which, stretching northward for about 40 miles, is united with the Erie Canal by a short branch canal. Although Seneca Lake is slightly larger than Cayuga, Watkins is much smaller than Ithaca. The fact that Cornell University is at Ithaca partly accounts for the difference in size, but even aside from this there are excellent reasons of a geographic nature which encourage the growth of a larger city at the head of Cayuga Lake.

In the first place, all the people at the head of Cayuga Lake are concentrated in one city (Fig. 5), while near the head of Seneca Lake there are two centers to divide the population. Less than three miles south of Watkins is Montour Falls (Fig. 6), whose location depends, first, on water power and, secondly, on the fact that valleys from the southwest and southeast converge toward this point instead of toward Watkins. The lower steepened valley slopes are too steep here for railroads to descend to Montour Falls from the hanging valleys along which they approach the Seneca valley, but wagon roads descend at this point so that at Montour Falls an east-west route intersects the north-south cross route.

A second reason for the larger size of Ithaca is the fact that there is a much more perfect convergence of highways there (Fig. 1). To the north is the lake valley; to the south the through valley leading

to Sayre; to the southeast the through valley leading to Owego; to the northeast the through valley leading to Cortland and Syracuse, or, by a branch through valley to Auburn. Along each of these routes a railway runs. A third geographic condition favoring the greater size of Ithaca is the fact that it is on the most direct coal route from the anthracite fields to the northern highway. One of the first roads for the distribution of anthracite was built to Ithaca, whence the coal was sent by boat down the lake to the Erie Canal. The increase in the use of railroads for this purpose, and the decline in the relative usefulness of the canal, long ago diverted the coal traffic that promised to center on Ithaca; but this factor had much influence on the early growth of Ithaca and is still of some importance.

A factor seriously interfering with the growth of Ithaca is the character of the converging valleys. The one from the south, leading toward Sayre, is not a perfectly developed through valley, for its divide, though greatly lowered, was not completely erased by glacial erosion and deposit. Accordingly, there is a heavy grade between Ithaca and the divide; and on leaving Ithaca for the north the railway must again climb out of the valley, ascending the steepened slope by a heavy grade. It was the presence of these grades that led the Lehigh Valley Railway Company to adopt the Seneca route for its main double-tracked road, leaving Ithaca side-tracked on a branch line. The through valleys from the southeast and northeast approach Ithaca high above the Cayuga valley bottom and terminate as broadly open hanging valleys on the upper edge of the steepened main valley slope. This condition has seriously affected the railway approach to Ithaca. One line from the south descends the steepened valley slope to the level of Ithaca by a switchback (Fig. 5); the other keeps up in the hanging valley and, swinging off at right angles, passes on to the northeast along the other hanging valley, not descending to the town at all (Fig. 5). It is on the plateau where the hanging valleys terminate on the steepened slope that Cornell University is situated.

The influence of the approach of through valleys to the main valley, together with their termination high up above the valley bottom, from which they are separated by the steepened slope, has had an even more serious effect on Watkins than on Ithaca (Fig. 6). Thus the main line of the Lehigh Valley Railway keeps up above the edge of the steepened slope and the station for Watkins is three miles from the town; while the Fall Brook branch of the New York Central has its Watkins station a mile from the town; and in each case the station is over 500 feet above the town (Figs. 4 and 6).

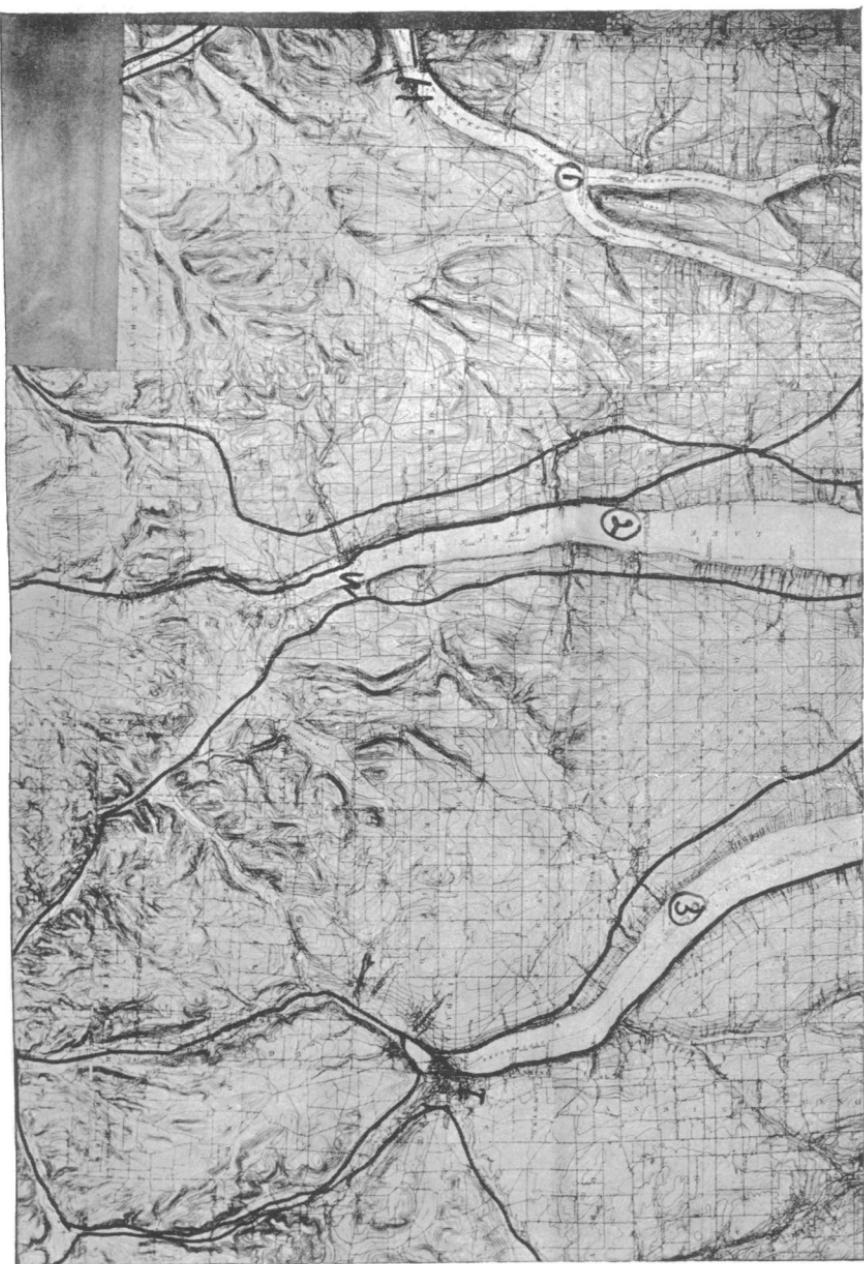


FIG. 4—Photograph of the U. S. Geological Survey topographic map, showing lake head towns, and location of Ithaca (I), Watkins (W) and Hammondsport (H). (1) Keuka Lake; (2) Seneca Lake; (3) Cayuga Lake.

Both of these lines are double-tracked railways, one tapping the anthracite, the other the bituminous coal fields; but because of the peculiar topography their influence on Watkins is very slight.

There are lake head towns at or near the heads of the other larger Finger Lakes,—Naples near the head of Canandaigua Lake, Hammondsport at the head of Keuka Lake, and Moravia near the head of Owasco Lake; but there are no towns at or near the heads of Skaneateles or Otisco lakes; doubtless, partly because these lakes are so small and partly because there is little tributary country and no convergence of valleys. Of the lake head towns only two,—Watkins and Hammondsport (Fig. 4), are exactly on the lake. Ithaca is nearly at the lake head and is connected with it by a navigable inlet, but the town is separated from the lake by a mile of delta swamp. Similar swamps separate Moravia and Naples from the lakes, and they are situated at the points nearest to the lake where there is a good town site and at the entrance of lateral routes. Moravia is at the mouth of a valley from the east (Figs. 1 and 3), and Naples at a point where valleys converge from the south, east, and west.

All of these lake-head towns are located on routes of travel of secondary importance—cross routes—and in a hilly plateau country of only moderate resources. Even where other routes converge upon them, they are minor in importance to the cross route itself, so that there is little contribution of resources either from the surrounding country or from abroad. Consequently, it could not be expected that any of these places should attain large size or great importance as industrial centers. They are, in the main, little more than distributing centers for a small area of country of no great productiveness. Geographic laws are inflexibly opposed to their growth beyond certain moderate limits. The operation of the same laws that have led to the growth of New York and Buffalo, to the smaller cities of Syracuse and Rochester, and the still smaller centers of Binghamton and Elmira, have determined for these lake-head towns and others on the cross routes of central New York an even more subordinate rank.

LAKE OUTLET TOWNS. The lower ends of the lakes have, on the whole, proved more favorable sites for towns than the upper ends (Fig. 1). There are some apparent contradictions to this statement; but the total of the lake outlet town population is far in excess of the total of the lake-head towns. There are several reasons for this. In the first place the lake outlet towns are distributing centers for products brought from all along the lakes and they thus



FIG. 5—Photograph of the U. S. Geological Survey topographic map to show the location of Ithaca, and the railway lines leading to it.
C. U. is site of Cornell University.

have a large contributing area; secondly, they are nearer the great northern highway toward which products tend; thirdly, they are in a more open and much more fertile country than the lake-head towns which are situated in the bottoms of valleys deeply sunk in the hilly plateau; and finally, a number of the lake outlet towns have water power regulated by a large lake.

Most of the lake outlet towns are exactly on the lake or on navigable outlets close by the lake. Canandaigua is practically at the outlet of Canandaigua Lake, as is Penn Yan on Keuka Lake and Skaneateles on Skaneateles Lake. Auburn is about three miles from Owasco Lake, making use of water power from the outlet stream. The absence of a large town at the outlet of Cayuga Lake is notable, for the town of Cayuga is the smallest of all the lake outlet towns, while Ithaca at the head of Cayuga Lake is the largest of all the lake-head towns. The absence of a large town at the lower end of Cayuga Lake is due to several facts, as follows:—(1) the presence of a very extensive area of swamp there; (2) the near presence of large towns serving the needs of the surrounding region; and (3) the development of Seneca Falls, three miles west of the head of Cayuga Lake, on the site of a fall in the outlet of Seneca Lake.

The lake outlet towns fall into a fairly straight line, and this fact (Fig. 1), together with the cause for it, has had not a little influence on their growth. From Syracuse westward the great northern highway extends as an open and easily traversed route; but from Syracuse southwestward there are two barriers to free travel: (1) the hilly plateau, (2) the long Finger Lakes. Routes to the southwest therefore, follow the northern edge of the plateau and swing around the lake heads. This makes the lake-head towns the crossing points of north-south cross routes and an east-west route diverging from the northern highway. The towns along this diverging route—Marcellus, Skaneateles, Auburn, Owego, Seneca Falls, Waterloo, Geneva and Canandaigua—exceed in population the combined population of the towns on the northern highway between Syracuse and Rochester. The growth of these lake-head towns so near the northern highway has doubtless had the effect of diminishing the growth and prosperity of the towns along the Erie Canal between Syracuse and Rochester.

THE LAKE SHORES. The shores of the lakes are remarkably barren of towns (Figs. 1, 4, and 7). Throughout most of their extent there are none. One reason for this is the absence of sites, for the valley sides descend steeply to the lake, often terminating in



FIG. 6.—Photograph of the U. S. Geological Survey topographic map to show the location of Watkins (W), Monour Falls (M. F.), Burgett (B), and Odessa (O).

a shale cliff faced by a narrow gravel beach. A second reason is the fact that, in general, the side valleys converging upon the main lake valley are short and, therefore, serving only a small tributary country. Moreover, these lateral valleys usually terminate as hanging valleys several hundred feet above the lake level, being extended to the lake by narrow, steep-walled gorges, occupied by a succession of cascades and waterfalls.

Here and there the streams have built deltas out into the lakes, and these are in many cases seized upon as the sites of hotels and summer cottages, or even, in some cases, as a small village center. In one or two places, as at the mouth of Salmon Creek on the east side of Cayuga Lake, the deltas have been utilized as the sites of salt plants; and at one or two places, as at Dresden on the west side of Seneca Lake, the entrance of a valley—the outlet of Keuka Lake—which can be traversed by roads and which opens up a fairly large tributary country, has led to the development of a town of some importance. Toward the north, where the lake valley walls become less steep, so that town sites on the lake shore are possible, there is more settlement and there are even some villages. This condition finds its best illustration on the east side of Cayuga Lake, where Aurora, Levanna and Union Springs are located.

In general, though, the lake shores are free from centers of population between the lake head and lake outlet. Towns and villages are much fewer and smaller along these parts of the cross routes than along any other portions of either these particular cross routes, or of others in the plateau region of central New York. Indeed, except at the lake heads and lake outlets, there is not a single large town or city in the hundreds of miles of lake shore line. A single geographic factor, water transportation, invites centers of population, and one might at first be surprised at their absence; but other geographic influences either oppose or prohibit such centers.

GORGE HEAD TOWNS. The absence of centers of population along the lake shores is related to another phenomenon. The lake shores themselves are not natural highways, for along most of the lake shores there are only narrow gravel beaches backed either by a wave cut cliff or by a steeply rising hillside. The hillslope above the wave cut cliff is also unfavorable for a highway, because of the fact that the steepened valley slope is gashed by numerous gorges cut in the shale by the streams descending the steepened slope from the hanging and other upland valleys (Figs. 4, 6 and 7). There are scores of such gorges on either side of Cayuga and Seneca Lakes; and in the other of the Finger Lake valleys similar conditions exist, though in much less pronounced manner.

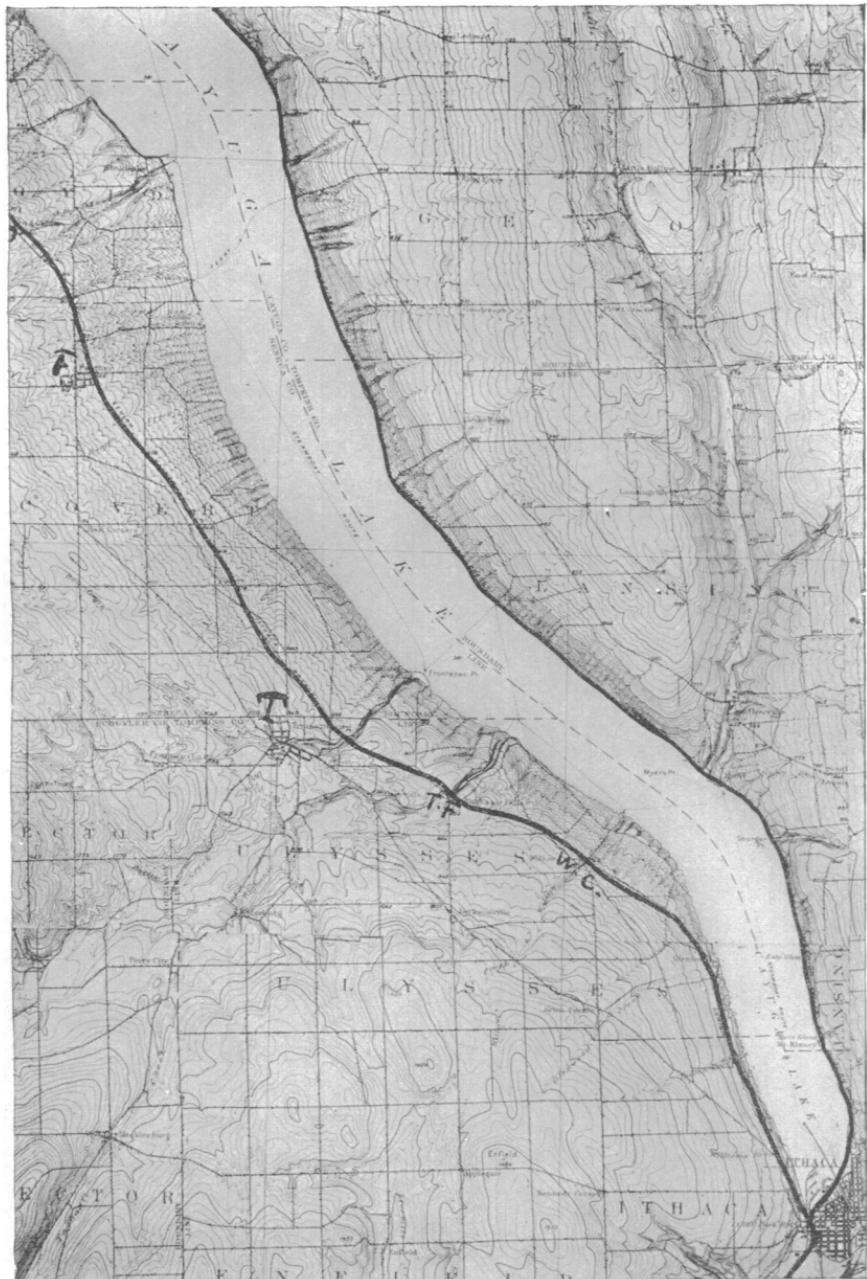


FIG. 7—Photograph of the U. S. Geological Survey topographical map showing the steepened lower slopes of the Cayuga valley, the gorges and the gorge head towns. O, Ovid Center; F, Farmer; T, Trumansburg; T F, Taghannic Falls; W C, Willow Creek.

For free travel north and south along the shores of these lakes, especially the two larger, it is necessary to go back some distance from the lake, above the edge of the steepened slope, in order to pass around the gorge heads and thus avoid the necessity of expensive bridges. Roads have been more influenced by this condition than railroads, though they, too, show evidence of its influence. The influence of the steepened slope and the associated gorges is best illustrated on the west side of Cayuga Lake, where both the roads and the railway are deflected by the topographic conditions. The roads were first deflected and centers of population have developed at points along them where other geographic conditions favored, as for instance, the entrance of a side valley, or the presence of water power, or the convergence of roads. Thus, at a distance of from one to three miles back from the lake one finds a succession of villages either at gorge heads or along the highway which extends above the gorge heads (Fig. 7). Here are found Newfield, Enfield Falls, Willow Creek, Taghanic Falls, Trumansburg, Covert, Farmer, Ovid Center and other villages, while to the eastward as far as the lake shore, and westward to the gorge head towns of Seneca valley there are no centers of population of equal size.

The east side of Cayuga Lake and both sides of Seneca Lake illustrate the same geographic influence (Fig. 4), but it is not necessary to specify the villages involved, for a glance at a topographic map will show the chain of villages whose location has been thus determined. That the roads are more under this influence than the railroads finds clear proof on the east side of Seneca Lake (Fig. 6), for here the gorge head towns of Burdett and Hector are below the railway, while Lodi and Ovid are above the railway; but all are on the main wagon road.

EFFECT OF CONVERGENCE OF ROUTES. In this region, as elsewhere, the question of highways is fundamental in influencing the location and growth of centers of population. While there are cases where towns have grown up on a single highway, by far the greatest number are situated at points where two or more routes converge. This has been illustrated again and again by the towns described above,—for example, Binghamton (Fig. 2), Sayre, Elmira (Fig. 1), Ithaca (Fig. 5), Cortland (Fig. 3), Rochester, and, in fact, almost all the others mentioned in the preceding pages.

Besides these illustrations of the influence of convergent routes, one can find scores of illustrations among the smaller villages and even among the crossroad hamlets. Mecklenburg, Lisle, Spencer, Van Etten and a multitude of other places illustrate this influence

among the smaller towns, some of them on the cross routes, some away from them, but almost all in valleys. The influence of convergent routes is much more noticeable in this hilly country than it would be in a more level region; and it becomes more and more noticeable in the more hilly parts of the plateau, for here the topography has increasing influence in directing the roads. The effect of the convergence on the size and growth of the towns has evidently been proportional to:—(1) the number of converging routes, (2) the extent of contributing country thus centered at the point of convergence, and (3) the facilities of transportation over the various routes. With the convergence of more than two highways, connecting with a wide area of country, and offering railroad transportation, good-sized towns and cities have developed, as at Binghamton and Cortland; but with convergence of wagon roads alone, and the bringing of a limited area tributary to the point of convergence, only small villages like Richford and Mecklenburg have been possible.

The influence of convergence of routes may be traced down to the very smallest centers, and even in the more remote parts of the upland. For example, the village of Virgil, at an elevation of 1,420 feet, is located at a point where roads following upland valleys converge, and it may be taken as a type of scores of similar upland villages and hamlets. While these are usually in the valleys, there are some cases where the hamlets are on the upland itself, as at North Barton at an elevation of 1,580 feet. In such locations, however, the centers are merely four-corners, with a half dozen or a dozen houses, a church and a school-house. This is, however, an illustration of the influence of convergence of routes, just as certainly as in the cities mentioned; but the routes open up a limited area of sparsely settled contributing country of little productivity, and the facilities of transportation are of the poorest—hilly roads, snow-covered in winter and deep in mud during spring and fall.

Many and probably most of the points where there is a distinct convergence of easily travelled routes received their first impulse of growth in the early days of stage-coach travel. Some of these points have increased greatly in size and importance under the influence of the railroad; but others, now side-tracked, have either shown no marked growth or have actually declined. Stage routes did not necessarily follow the graded valleys which the railroads now occupy; and since their object was the carrying of passengers and small packages rather than freight, they often sought different directions. For example, one of the principal stage routes in central New York

was the Catskill turnpike, running up hill and down in a general southeast direction. It crossed the through valleys here and there, as at Lisle, Richford and Ithaca, but it did not follow them as the railroads do. In the days of the stage-coach this was a busy thoroughfare,—for the time; but now the arteries of trade cross it at right angles, and it has little more importance than the other roads between small settlements. Signs of the former importance of this highway are evident every here and there; but nowhere more clearly than at Sullivanville, a few miles north of Elmira. This is a veritable deserted village, with its fine large hostelries all closed and in a sad state of decay.

INFLUENCE OF MINERAL RESOURCES. The central New York plateau is not rich in mineral resources and, therefore, there is little direct influence of mineral wealth; but all the region is greatly influenced by the neighborhood of coal in Pennsylvania and by the facilities for transportation of other mineral substances from outside.

Syracuse is the best instance of the direct effect of mineral deposits on the growth of the towns of this section. Salt springs led to its location; a thriving salt manufacturing industry followed, and some is still carried on; and the introduction of salt water from the south has given the basis for the industry of soda-making at Solway, a suburb of Syracuse. Salt is also obtained at several other points from the extensive bed that underlies the plateau of central New York; for instance, there are two salt-making plants at Ithaca and another a few miles farther north, while there are also several in the Seneca valley at and near Watkins. These works have had only minor influence in the growth of the towns.

There are clay workings at a few points, giving support to small centers of population, as at Nina, south of Ithaca; stone quarries, as at Farley's, on the east shore of Cayuga Lake; gypsum quarries at several points, and cement works at Portland, north of Ithaca. To these mineral industries, dealing with heavy imperishable commodities, the facilities of water transportation along the Finger Lakes and the Erie Canal have been of the greatest importance; but neither of the industries has of itself led to the growth of large centers of population.

There are some spring waters of repute which have led to or aided in the growth of several small centers, as at Slaterville Springs, Watkins and Clifton Springs, the former a summer resort of some note, the two latter the seats of well-known Sanitaria. On the whole, therefore, the influence of mineral resources on the location

and growth of towns in central New York has been of only very slight importance.

THE INFLUENCE OF WATER POWER. The finest power in this part of the State is at the falls of the Genesee at Rochester, and this power has been of basal importance in the location and growth of Rochester. Some of the lake outlets also furnish power, though others are sluggish. This is true, for instance, of the largest outlet of all, Seneca River, which carries the combined waters of Cayuga and Seneca Rivers in sluggish course over an extensive area of swamp land. This is most unfortunate, since there is here a large body of water regulated in the huge reservoirs of the two largest of the Finger Lakes.

Skaneateles outlet furnishes power to villages along its course, as at Skaneateles Falls; Owasco outlet furnishes power to Auburn; Seneca outlet to Seneca Falls (Fig. 1); and other power of minor importance is supplied at other points by the lake outlet streams. Further west the Portage Falls of the Genesee are valuable for their water power.

Along the steepened slopes of the north-south valleys there are a multitude of waterfalls, especially in the southern half of the Seneca and Cayuga valleys. Some of these had early influence in the location and growth of towns, as at Montour Falls and Ithaca; but their present influence is of little value. All the streams are short, and their volume is variable, having been rendered even more so by the stripping off of the forest from the upland. Even the largest of these streams often run nearly dry in summer; and in winter their volume shrinks by freezing. They are, therefore, most unreliable as sources of power, even with the aid of such small reservoirs as have been built to store the waters for use in times of drought.

At certain seasons, and often for weeks at a time, there is an enormous amount of water power going to waste in the gorges that gash these ice-steepened valley walls. If the storage battery ever becomes perfected, there is here an asset of great value; and, even without it, there are opportunities for the development of large quantities of regulated power by the building of extensive storage reservoirs. That this will ever be done in a region of such limited resources can hardly be predicted with safety. Possibly, for all time the hundreds of streams with fluctuating water power will be allowed to run to waste as now.

DETAILS OF LOCATION. Besides the general geographic factors determining the location of towns and cities in the central New

York region, there are minor geographic influences that have led to the determination of the exact sites of towns. For example, where one or more hanging valleys open out at the upper limit of the steepened slope of the main valley there are often small plateaus well above the main valley bottom, and separated from it by a steep valley side on which a town site would not normally develop. This condition is best illustrated by the site of Cornell University, which occupies such a hanging valley plateau over 400 feet above the main valley bottom (Fig. 5). There is here a fairly level site and here are situated the University buildings, together with a large number of residences, making a small town. Below, in the valley bottom is Ithaca, with four hundred feet of steep hillside between. Naturally, under the peculiar conditions existing here, with an important institution above, and the business center below, the adverse geographic conditions of a steep hillside have been in part ignored; streets are run up the steep slope and house lots have been established by grading. Thus the University site and town site are connected by a continuous series of hillside houses along a portion of the steepened valley slope. It is the only case in the plateau of central New York where a section of the steepened valley side has been chosen as the home site for a large number of people.

Elsewhere in the Cayuga and Seneca valleys there are instances of villages built at the outer edge of the hanging valleys, and these are, naturally, also gorge-head towns. Of these Trumansburg in the Cayuga valley (Fig. 7), and Odessa, Burdett (Fig. 6), and Dundee in the Seneca valley may be taken as illustrations.

Another type of village site on the valley slopes is that furnished by the hanging deltas that were built in the lake waters when a glacier dam across the northern part of the Cayuga and Seneca valleys caused the lake waters to rise high above their present level. These sites are often used for the location of single houses or small groups of houses, as at Ithaca near the University campus; and in at least one case, North Hector in the Seneca valley, one of these deltas is the site of a small village. A part of Trumansburg is also built on such a hanging delta.

Alluvial fans are favorite sites for valley towns and villages. This is due to three causes:—(1) the fact that the valley bottoms are often level and damp; (2) the fact that the alluvial fans are built up at the points where lateral streams enter the main valley, and are therefore at the convergence of highways; and (3) the fact that the alluvial fans are slightly elevated, are built of gravel through which water easily percolates, and have slopes down which

the surface water easily runs,—all factors aiding in making dry sites for houses.

Scores of instances of towns and villages on alluvial fans are found in the plateau region. In some cases the influence of the fan in determining the town site is very noticeable. For example, Watkins and Ithaca are both located on a swampy delta at the lake head, and in general, without artificial drainage or extensive filling, these deltas are uninhabitable near the lakes. The alluvial fans of Six Mile, Cascadilla and Fall Creeks have built up a part of the delta on the east side of the Cayuga valley near the lake head, so that a portion of the delta surface is no longer swampy; and Glen Creek at Watkins has made a similar alluvial fan on the west side of Seneca Lake head. These dry sites have become town sites in the midst of swamp land.

Outwash gravel plains built during the recession of the continental glacier, being well drained, have served as excellent town sites in many of the valleys. Horseheads, Elmira, Spencer, Candor, and Owego are illustrations of this class of town site.

SUMMARY. Summarizing briefly the underlying principles which have determined the location and growth of the towns and cities of central New York, it is clear, in the first place, that the question of highways is the point of primary and basal importance. The principal towns are on the leading highway in the north; and the towns next in size are on the secondary highway in the south. The other towns of the region are on byways and cross routes between the two main highways. The small size and limited growth of the latter are due mainly to the following geographical conditions:—(1) they are on byways; (2) they are in the midst of a rugged, dissected plateau, offering obstacles to easy travel by rail or road, except along a limited number of routes; (3) the plateau, a region of hilly upland with prevailingly thin, stony, infertile soil, is a region of limited agricultural resources with a diminishing population; (4) there is little water power; and (5) there is a general lack of important mineral resources.

The invasion by the continental glacier has unfavorably influenced the region: (1) by making many steep slopes where the valley sides were moderately sloping before the Glacial Period; (2) by sweeping off the soil of residual decay and leaving glacial soil in its place—though in places this was, doubtless, an advantage rather than a disadvantage; (3) by interfering with drainage, flooding some lands, giving rise to gorges, and altering stream directions. On the other hand, the glacial invasion has been a benefit to the

region in some directions, notably in giving rise to water power in some places, in bringing about conditions which have made lake navigation possible, and finally, by causing the through valleys. This latter work of the glacier is of great significance, and probably counterbalances all the disadvantages. The through valleys have guided the course of railways, some of them trunk lines, along the cross valleys; and where the through valleys converge, towns and cities have naturally grown.

Altogether, the central New York plateau region illustrates perfectly the relation between man and his environment. Geographic conditions unfavorable to many forms of agriculture have led to a change in the industry and a decline in the farming population; they have been adverse to mining and manufacturing; and they have been unfavorable to the growth of large centers of population. The location of these centers, as well as their growth, has been guided by geographic conditions, and the influence of those conditions may be traced in various directions, even in minute detail; but, in the main, the growth of towns and cities has been dependent primarily upon the routes of travel, which are dependent directly upon the topography.

GEOGRAPHY AND SOME OF ITS PRESENT NEEDS*

GEOGRAPHICAL PROGRESS IN THE LAST DECADE

Among the many geographical results of work in the past decade a few may be mentioned. The measurement of new and the re-measurement of old arcs will give us better data for determining the size and shape of the Earth. Surveys of all kinds, from the simple route sketches of the traveler to the elaborate cadastral surveys of some of the more populous and settled regions have so extended our knowledge of the surface features of the Earth that a map on the scale of 1:1,000,000 is not merely planned, but actually partly executed. Such surveys and such maps are the indispensable basis of our science.

The progress of oceanography has also been great. The sound-

* This article presents most of the opening address of A. J. Herbertson, M.A., Ph.D., Professor of Geography at the University of Oxford, delivered as President of Section E, Geography, at the recent meeting of the British Association for the Advancement of Science. The paper is printed in full in *Nature*, Sept. 22, 1910.